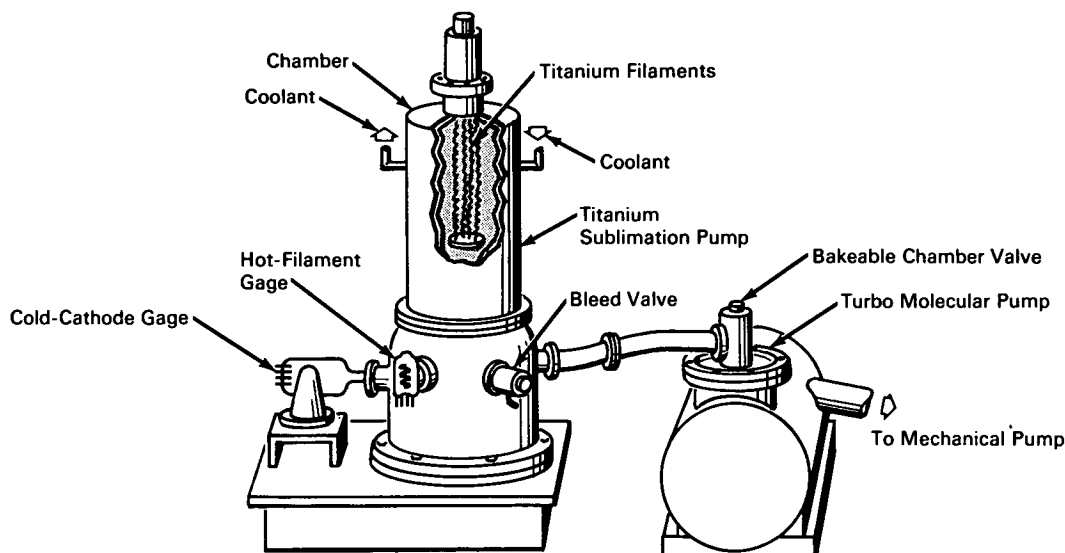


## NASA TECH BRIEF



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### Auxiliary Titanium Sublimation Pump Produces Ultrahigh ( $10^{-11}$ Torr) Vacuum

**The problem:**

To develop a simple, ultrahigh vacuum pumping system for research studies of residual gas analyzers and vacuum gages. The system must not require continuous attention in the course of producing an ultimate pressure of  $10^{-11}$  torr.

**The solution:**

The use of sublimated titanium as a gettering agent in conjunction with a turbine-type (molecular drag) pump. The latter pump alone will evacuate the chamber to a pressure of  $10^{-9}$  torr. The residual gas, mostly hydrogen, is removed by the gettering agent at a pumping speed of approximately 15 liters per second per square inch. This combination provides an easy

two-step procedure for obtaining an ultrahigh vacuum of  $10^{-11}$  torr.

**How it's done:**

The titanium sublimation pump is separated from the turbine pump by a bakeable valve. This separation prevents backstreaming of the turbine pump vapors at pressures lower than  $1 \times 10^{-10}$  torr. Initially the turbine pump evacuates the chamber to a pressure of  $5 \times 10^{-8}$  torr. After a bakeout at  $400^\circ\text{F}$ , the bakeable valve is closed and the titanium filaments are heated to sublimate the titanium on the cooled chamber surface. The hydrogen and other gases are adsorbed on the coated surface, and the ionic action of a cold-cathode gage supplements the pumping of gases not

(continued overleaf)

readily adsorbed by the titanium. Three additional one-minute sublimations are required to reach  $1 \times 10^{-11}$  torr, and a sublimation is required every three days to maintain this pressure level. Total pump-down time to obtain this pressure was five days after the valve was closed.

**Notes:**

1. The use of a cryogenic coolant in the chamber jacket shortens the pumpdown time, but its effect decreases as the chamber pressure drops.
2. The lowest pressure indication obtained with this system was  $7 \times 10^{-13}$  torr.

3. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
Langley Research Center  
Langley Station  
Hampton, Virginia 23365  
Reference: B66-10388

**Patent status:**

No patent action is contemplated by NASA.

Source: Ronald A. Outlaw  
(Langley-212)